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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/714,180	11/14/2003	Peter C. Rieke	50005-162	9390
32215 7590 11/30/2009 KLARQUIST SPARKMAN, LLP 121 SW SALMON STREET, SUITE 1600 ONE WORLD TRADE CENTER PORTLAND, OR 97204			EXAMINER LEWIS, BEN	
			ART UNIT 1795	PAPER NUMBER
			NOTIFICATION DATE 11/30/2009	DELIVERY MODE ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/714,180	RIEKE ET AL.	
	Examiner	Art Unit	
	Ben Lewis	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 September 2009.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-10,13-29,32-38,96-101,103-120,122-128 and 130-132 is/are pending in the application.
- 4a) Of the above claim(s) 96-101,103-108 and 111 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-10,13-29,32-38,96-101,111-120,122-128 and 130-132 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 November 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)</p> <p>2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)</p> <p>3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____.</p> | <p>4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.</p> <p>5) <input type="checkbox"/> Notice of Informal Patent Application</p> <p>6) <input type="checkbox"/> Other: _____.</p> |
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DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 23rd, 2009 has been entered

Claim Rejections - 35 USC § 112

1. The claim rejections under 35 U.S.C. 112, first paragraph, on claims 17, 36 and 126 are withdrawn, because "said cathode layer comprises a substantially homogenous mixture of a copper-substituted ferrite material and a finely-divided form of a second material" has been described in the specification as originally filed.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1-10, 15-19 and 112, 113, 115 rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.))

With respect to claims 1,3, 4, 115, Aizawa et al. (US 6,692,855) teaches a solid oxide fuel cell for electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned in contact with the first surface of said electrolyte layer; and a conductive cathode positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum oxide material. The modified lanthanum oxide material is in direct contact with said zirconium-containing material; and wherein said fuel cell has a power density of at least about 1.0 W/cm² at 750°C and 0.7V. The reference does not teach a cathode comprising a modified lanthanum ferrite perovskite.

Kindermann et al. teaches a cathode material for a solid oxide fuel cell that produces electricity by electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned is inherently in contact with the first surface of said electrolyte layer; and a conductive cathode positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum ferrite perovskite material; wherein said modified lanthanum ferrite perovskite material is in direct contact with said zirconium-containing material; and wherein said fuel cell includes a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cathode material taught in Kindermann et al. in a fuel cell having the structure taught in Aizawa in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1.) The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artesian

would have found the claimed invention to be obvious in light of the teachings of the references.

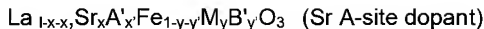
With respect to claim the fuel cell being operable at temperature less than about 750 °C, Aizawa et al as modified by Kindermann do not disclose fuel cell operating temperature data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al as modified by Kindermann and the present application utilize the same copper substituted ferrite perovskite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 2 and 7, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant

With respect to claims 5 and 6, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant

With respect to claims 8, 112-113, Kindermann et al. teach that M = Cr, Mn, Ni or Co (Pg 909 Col 2).

With respect to claims 9-10, Aizawa et al. as modified by Kindermann et al. teach a fuel cell including a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artisan would have found the claimed invention to be obvious in light of the teachings of the references.

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula: $\text{La}_{1-x} \text{A}_x \text{B}_y \text{Fe}_{1-y} \text{O}_3$. See Page 11, Lines 20-22. Aizawa et al. as modified

by Kindermann et al. do not disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al. as modified by Kindermann et al. and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

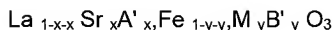
With respect to claims 15 and 16, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

4. Claims 13-14, 32-33, 122 and 123 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.)) in view of Badding et al. (U.S. Pub. No. 2001/0044041 A1).

With respect to claims 13-14, 18, 32-33, 122 and 123, Aizawa et al. as modified by Kindermann et al. disclose a solid oxide fuel cell above. Aizawa et al. as modified by Kindermann et al. do not specifically teach wherein the copper substituted ferrite material comprises a layer having a thickness from about 1 to 50 microns or having a thickness from about 1 to 30 microns. However, Badding et al. disclose high performance solid oxide electrolyte fuel cells (title) wherein With more conventional perovskite-type electrode materials such as $\text{La}_{0.85}\text{Sr}_{0.15}\text{MnO}_3$, or other manganites, electrode resistivity is typically about 10×10^{-2} ohm-cm, or essentially 3 orders of magnitude higher than the resistivities of precious metal-containing electrodes. In these cases the electrode designs generally involve smaller electrodes with shorter current path lengths (as low as 2 mm), higher electrode thicknesses, (>20 microns), and/or highly conductive current collectors in contact with the electrodes. Electrodes less than around 20 microns in thickness, however, are generally preferred for minimizing material usage and enhancing the flexibility and thermal shock resistance of the electrode/electrolyte structure (Paragraph 0056). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to use the electrode thickness of Badding et al. for the cathode thickness of Aizawa et al. as modified by Kindermann et al. because Badding et al. teach that Electrodes less than around 20 microns in thickness, however, are generally preferred for minimizing material usage and enhancing the flexibility and thermal shock resistance of the electrode/electrolyte structure (Paragraph 0056).

5. Claims 1, 20-29, 32-38, 112-120, 124-125, 127-128 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Forthmann et al. (Ceramic coatings for cathode contacts of solid oxide fuel cells, Werkstoffwoche '98, Band II 1: Symposium 3, Werkstoffe fuer die Energietechnik; Symposium 7, Werkstoffe und Korrosion, Munich, Sept., 1998 (1999), Meeting Date 1998, 149-154 and further in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997).)

With respect to claims 1,3, 4, and 20, 23, 24, 25, 27, 37, 114, 115, 117, 118, 119, 127, 128, the teachings of Aizawa et al. (US 6,692,855) and Kindermann et al. have been presented. The reference does not teach a cathode comprising a modified lanthanum ferrite perovskite as claimed. Forthmann et al., however, teaches a cathode material for a solid oxide fuel cell that produces electricity by electrochemically reacting a fuel gas with an oxidant gas to produce a DC output voltage, said solid oxide fuel cell comprising a layer of ceramic ion conducting electrolyte defining first and second opposing surfaces, said electrolyte comprising a zirconium-containing material; a conductive anode positioned is inherently in contact with the first surface of said electrolyte layer; and a conductive cathode positioned in contact with the second surface of said electrolyte layer, said cathode comprising a modified lanthanum ferrite perovskite material; wherein said modified lanthanum ferrite perovskite material is in direct contact with said zirconium-containing material; and wherein said fuel cell includes a cathode layer of a perovskite composition having the formula:



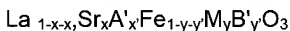
wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. The fuel cell cathode contact layer comprised a perovskite (LASK) $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$ (see the Abstract). Forthmann et al. teach that the (LASK) $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$ were sintered onto the interconnectors of the fuel cell stack (See abstract). Forthmann et al. teach interconnects with gas passages (See Fig. 2). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cathode material taught in Forthmann et al. in a fuel cell having the structure taught in Aizawa as modified by Kindermann et al. in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1.) The amount of copper in the material is considered to be about 0.01 to about 0.05 because 0.2 is about 0.05." Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to alter the amount of copper in the material in order to achieve the desired properties of the stabilized material. Where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation, In re *Aller, Lacey and Hall*, 105 U.S.P.Q. 233,235. The artesian would have found the claimed invention to be obvious in light of the teachings of the references.

With respect to claim the fuel cell being operable at temperature less than about 750 °C, Aizawa et al. as modified by Forthmann et al. and Kindermann et al. do not disclose fuel cell operating temperature data. However, it is the position of the

examiner that such properties are inherent, given that Aizawa et al. as modified by Forthmann et al. and Kindermann et al. and the present application utilize the same copper substituted ferrite perovskite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claim 19, Forthmann et al. teach that the (LASK) $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$ were sintered onto the interconnectors of the fuel cell stack (See abstract).

With respect to claims, 28-29, Aizawa et al. as modified by Forthmann et al., teach a fuel cell including a cathode layer of a perovskite composition having the formula: $\text{La}_{1-x}\text{Sr}_x\text{A}'_x\text{Fe}_{1-y-y'}\text{M}_y\text{B}'_{y'}\text{O}_3$



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4; and y' is from 0 to about 0.4, A' is an A-site dopant, and B' is a B-site dopant. The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artisan would have found the claimed invention to be obvious in light of the teachings of the references.

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula: $\text{La}_{1-x}\text{A}_x\text{B}_y\text{Fe}_{1-y}\text{O}_3$. See Page 11, Lines 20-22. Aizawa et al. as modified by Forthmann et al.. do not disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Aizawa et al. as modified by Forthmann et al.. and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 19 and 38, Forthmann et al. teach interconnects with gas passages (See Fig. 2).

With respect to claim 21, 116, Frothmann et al. teach that the fuel cell cathode contact layer comprised a perovskite (LASK) $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$ (See Abstract). Therefore the copper is present at 4 atomic percent. Examiner notes that copper is a B-site atom in the LASK formula of Frothmann et al.

With respect to claims 22 and 26, Frothmann et al. teach that the fuel cell cathode contact layer comprised a perovskite (LASK) $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$ (See

Abstract). Therefore the copper is present at 4 atomic percent. 4 atomic percent reads on "about 5 atomic percent." Examiner notes that copper is a B-site atom in the LASK formula of Frothmann et al.

With respect to claims 34-35, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 112-113, Kindermann et al. teach that M = Cr, Mn, Ni or Co (Pg 909 Col 2).

With respect to claims 120, Forthmann et al. disclose a planar solid oxide fuel cell characterized by 2 porous electrodes and a gas impermeable solid electrolyte. The fuel cell cathode contact layer comprised a perovskite (LASK) $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$ (See Abstract).

The instant specification recites: The perovskite crystal structure of an A-site and B-site-substituted lanthanum ferrite perovskite is represented by the general formula: $\text{La}_{1-x} \text{A}_x \text{B}_y \text{Fe}_{1-y} \text{O}_3$. See Page 11, Lines 20-22. Forthmann et al do not

disclose any polarization resistance data. However, it is the position of the examiner that such properties are inherent, given that Forthmann et al and the present application utilize the same copper-substituted lanthanum ferrite material. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

With respect to claims 124 and 125, It is inherent that the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. comprises essentially the entire cathode layer since the cathode is made of the copper substituted ferrite material of Aizawa et al. as modified by Kindermann et al. A reference which is silent about a claimed invention's features is inherently anticipatory if the missing feature is necessarily present in that which is described in the reference. In re Robertson, 49 USPQ2d 1949 (1999).

6. Claims 130-132 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Forthmann et al. (Ceramic coatings for cathode contacts of solid oxide fuel cells, Werkstoffwoche '98, Band II 1: Symposium 3, Werkstoffe fuer die Energietechnik; Symposium 7, Werkstoffe und Korrosion, Munich, Sept., 1998 (1999), Meeting Date 1998, 149-154 and further in view of Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997).)

With respect to claim 130-132, Aizawa et al. as modified by Forthmann et al. and Kindermann et al. disclose a planar solid oxide fuel cell characterized by 2 porous electrodes and a gas impermeable solid electrolyte. The fuel cell cathode contact layer comprised a perovskite (LASK) $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_3$ (See Abstract). Forthmann et al. also disclose perovskite $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Ni}_{0.2}\text{O}_3$ (LSFN) (See page 150). Examiner notes the B site atom is Ni in (LSFN). Examiner also notes that Frothmann et al. also disclose perovskite LSM where the B site atom is Mn. Examiner also notes that Frothmann et al. disclose LSFC where the B site atom is Co (See page 150). The Frothmann reference does not teach wherein the electrolyte layer comprises a yttria-stabilized zirconium oxide, however Applicant teaches that Solid oxide fuel cells (SOFCs) employing a dense ceramic electrolyte are currently considered as one of the most attractive technologies for electric power generation. In a typical SOFC, a solid electrolyte separates the porous metal-based anode from a porous metal or ceramic cathode. Due to its mechanical, electrical, chemical and thermal characteristics, yttria-stabilized zirconium oxide (YSZ) is currently the electrolyte material most commonly employed. (Page 2 Applicant's Specification). Examiner notes that due to Applicants own admission of the use of yttria-stabilized zirconium oxide (YSZ) as an electrolyte material being well known in the fuel cell art it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the use of (YSZ) as an electrolyte material in the fuel cell of Forthmann et al.

7. Claims 17, 36 and 126 are rejected under 35 U.S.C. 103(a) as being unpatentable over Aizawa et al. (US 6,692,855) in view of Forthmann et al. (Ceramic coatings for cathode contacts of solid oxide fuel cells, Werkstoffwoche '98, Band II 1: Symposium 3, Werkstoffe fuer die Energietechnik; Symposium 7, Werkstoffe und Korrosion, Munich, Sept., 1998 (1999), Meeting Date 1998, 149-154, Kindermann et al. (J. Am. Ceram. Soc. 80 [4], 909-914 (1997.)) and further in view of Sarkar et al. (U.S. Pub. No. 2003/0134176 A1).

With respect to claims 17, 36 and 126, Aizawa et al. as modified by Forthmann et al. and Kindermann et al. disclose a planar solid oxide fuel cell characterized by 2 porous electrodes and a gas impermeable solid electrolyte above. Aizawa et al. as modified by Forthmann et al. and Kindermann et al. do not specifically teach wherein said cathode layer comprises a substantially homogenous mixture of copper-substituted ferrite composition and a finely-divided form of a second material. However, Sarkar et al. disclose a hollow inorganic membranes produced by metal or composite electrodeposition (title) wherein, according to one aspect of the invention, there is provided a method of producing a porous hollow inorganic electrode for a solid oxide fuel cell. The method comprises (a) depositing electrode material onto an electrically conductive combustible core, the electrode material including electrically conductive metal, ionically conductive ceramic particles, and combustible particles, wherein at least the metal is deposited by electrodeposition (Paragraph 0016-0017). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the conductive particles and material of Sarkar et al. into the cathode of

Aizawa et al. as modified by Forthmann et al. and Kindermann et al. in order to achieve adequate conductivity throughout the electrode.

Response to Arguments

8. Applicant's arguments filed on September 23rd, 2009 have been fully considered but they are not persuasive.

Applicant's principal arguments are

(a) Aizawa discloses $(\text{Ln}_{1-x}\text{Sr}_x)\text{MnO}_3$ or $(\text{Ln}_{1-x}\text{Ca}_x)\text{MnO}_3$ as potential SOFC cathode materials. Aizawa does not teach or suggest a ferrite perovskite material for use as a SOFC cathode. The Examiner alleges that Aizawa discloses "copper as a dopant in a lanthanum perovskite material." However, the copper-containing material disclosed in Aizawa et al. is a copper-containing lanthanum chromite material, not a lanthanum ferrite material as presently claimed. Also, the copper-containing lanthanum chromite is used as an interconnector, rather than as a cathode, and interconnector 117 does not appear to be in contact with the electrolyte layer 113, as required by claim 1. (See, e.g., col. 57, 11.16-48, and FIGS. 27A-B.) Thus, at best, Aizawa discloses a strontium- or calcium-doped lanthanum manganite cathode with a copper-doped lanthanum chromite

interconnector that is not in contact with the electrolyte layer. There is no teaching or suggestion in Aizawa to utilize a copper-doped lanthanum ferrite cathode in contact with the electrolyte layer.

(b) Kindermann provides no discussion of the respective merits of the transition metals listed, and provides no teaching or suggestion to select any transition metal other than the four listed metals. Simply because copper is also a transition metal does not mean that a person of ordinary skill in the art at the time of the invention would have predicted any gainful benefit attributable to copper compared to other transition metals in the context of lanthanum ferrite perovskite. Aizawa also does not point to any particular reason for selecting copper since Aizawa does not teach including copper in a cathode layer material.

(c) With respect to claims 2 and 5-7, the Examiner further contends that Aizawa modified by Kindermann teaches a fuel cell including a cathode layer of a perovskite composition having the formula:



wherein x is from about 0.05 to about 0.4; y is from about 0.01 to about 0.05; x' is from 0 to about 0.4, y' is from 0 to about 0.4; A' is an A-site dopant, and B' is a B-site dopant.

(Office action, page 5.) This conclusion is incorrect. Applicants find no support in either Aizawa or Kindermann for the above formula and substituent ranges, and again respectfully request that the Examiner indicate where such support can be found

(d) Kindermann neither teaches nor suggests a material having two B-site dopants, let alone a copper-substituted lanthanum ferrite material with a second B-site dopant. Aizawa also does not teach or suggest a copper-substituted lanthanum ferrite material having a second B-site dopant.

(e) Kindermann does not disclose the referenced formula. Nor does Kindermann teach or suggest using Cu as M. As set forth above in relation to claim 1, there is no suggestion or motivation provided by Kindermann or Aizawa to select copper in place of the transition metals listed by Kindermann. Thus, although the polarization resistance values of claims 9 and 10 may indeed be inherent to the material of claim 1, the combination of Aizawa and Kindermann fails to teach the copper-substituted ferrite perovskite material of claim 1.

(f) Forthmann discloses several compositions, including $\text{La}_{0.6}\text{Sr}_{0.4}\text{Fe}_{0.8}\text{Cu}_{0.2}\text{O}_{3}$ ("LSFK"). However, Forthmann indicates that the substituted lanthanum ferrite perovskites are less suitable than the other disclosed compositions: "[T]here is a pronounced chemical interaction of the substituted LaFeO_3 perovskites with the interconnector steel under formation of poorly conductive spinels (such as, for example, FeCr_{204}) that increase the transitional resistance to the interconnector." (Forthmann, page 150.) In contrast, effective coatings "show no or only a negligible chemical interaction with the cathode and the interconnector." (Forthmann, page 149.) Thus, Forthmann actually teaches away from using the LSFK formulation.

In response to Applicant's arguments, please consider the following comments.

(a), (b) and (e) The reference does not teach copper as M, however based on the teachings of a variety of transition metals, one of ordinary skill in the art would be motivated to use Cu as M in the lithium ferrite perovskite material taught by Kindermann. Further, Aizawa teaches using copper as a dopant in a lanthanum perovskite material (see col. 18, lines 40-50.) The artisan would have found the claimed invention to be obvious in light of the teachings of the references.

(c) Forthmann et al. teach that the (LASK) $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$ were sintered onto the interconnectors of the fuel cell stack (See abstract). Forthmann et al. teach interconnects with gas passages (See Fig. 2). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cathode material taught in Forthmann et al. in a fuel cell having the structure taught in Aizawa as modified by Kindermann et al. in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1 .) The amount of copper in the material is considered to be about 0.01 to about 0.05 because 0.2 is about 0.05." Further, it would have been obvious to one of ordinary skill in the art at the time the invention was made to alter the amount of copper in the material in order to achieve the desired properties of the stabilized material. Where the general conditions of a claim

are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation, In re *Aller, Lacey and Hall*, 105 U.S.P.Q. 233,235. The artisan would have found the claimed invention to be obvious in light of the teachings of the references.

(d) Kindermann et al. teach that $M = \text{Cr, Mn, Ni or Co}$ (Pg 909 Col 2).

(f) Forthmann et al. teach that the (LASK) $\text{La}_{0.6} \text{Sr}_{0.4} \text{Fe}_{0.8} \text{Cu}_{0.2} \text{O}_3$ were sintered onto the interconnectors of the fuel cell stack (See abstract). Forthmann et al. teach interconnects with gas passages (See Fig. 2). It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the cathode material taught in Forthmann et al. in a fuel cell having the structure taught in Aizawa as modified by Kindermann et al. in order to reduce the SOFC fuel cell operating temperature and generate electricity (see Kindermann, p. 909, col. 1 .) The amount of copper in the material is considered to be about 0.01 to about 0.05 because 0.2 is about 0.05." Examiner also notes that even though Forthmann teach LASK as a contact coating between the cathode and the interconnector examiner notes that this contact coating is part of the cathode and is made of LASK which is a material that facilitates cathode electrode reactions in a solid oxide fuel cell.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben Lewis whose telephone number is 571-272-6481. The examiner can normally be reached on 8:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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